



Carbon, oxygen, and hydrogen isotope fractionation during experimental formation of pirssonite

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The mineral pirssonite ($\text{Na}_2\text{Ca}[\text{CO}_3]_2 \cdot 2\text{H}_2\text{O}$) occurs in oil shales and sediments of evaporated lacustrine lakes as the Green River formation (Milton & Fahey, 1960) and Searles lake (Smith 1979). The stable isotopes of carbon, oxygen and hydrogen are extremely useful in deducing carbonate formation conditions and may preserve information about the paleoenvironment. For a correct interpretation of natural isotopic signals, however, a careful experimental calibration is fundamental. Less work has been done on hydrated carbonate minerals, so far. The present study is an extension of previous work, where stable carbon isotope fractionation during pirssonite formation was studied experimentally at 60 and 90°C (Böttcher, 1994). In the present study, stable carbon, oxygen and hydrogen isotope fractionation was investigated during experimental formation of pirssonite at 86±3°C. Pirssonite was formed via the transformation (dissolution-precipitation) of anhydrous calcium carbonate (natural aragonite, synthetic calcite) or natural gaylussite in aqueous sodium carbonate solution. This approach is similar to the one described by Bury & Redd (1930). The newly formed solid was enriched in ^{13}C and ^{18}O compared to the dissolved carbonate ion (essentially the carbonate ion and the sodium carbonate ion pair), and in ^{18}O compared to water. Deuterium, on the other hand, was depleted in the hydrate molecules of the pirssonite lattice compared to the aqueous solution.